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Use of Chick Embryo for *Brucella* Isolation

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Public Health Reports

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Availability of Fluorine in Sodium Fluoride vs. Sodium Fluosilicate

By F. J. McClure, Ph.D.*

Sodium fluoride is the source of fluorine for the majority of current studies testing the efficacy of fluoridation of community drinking water for the partial control of human dental caries (*1, 2, 3, 4, 5*). On the basis of solubility and availability of fluorine, as well as the innocuous character of the accompanying sodium, sodium fluoride is a logical source of fluorine. At the same time any large-scale program of community water fluoridation must calculate its cost, and other fluorine compounds may be available at less expense and may be equally efficacious. Thus, with sodium fluosilicate currently selling at about half the price of sodium fluoride, the cost of chemicals for the fluoridation of 1,000,000 gallons of water at an optimum level of 1.0 ppm fluorine is approximately $2.15 using sodium fluoride and 76 cents for an equivalent quantity of sodium fluosilicate.[1]

The consideration of a fluosilicate as a fluorine carrier instead of sodium fluoride has raised the question as to the relative physiological effects of a complex chemical such as sodium fluosilicate vs. sodium fluoride.

Generally speaking, the physiological effects of different fluoride salts will depend on their absorbability from the intestinal tract which may be a direct function of solubility, particularly if relatively large quantities are ingested. But if the quantities of fluoride ingested are very small, the effects of differences in solubility will tend to diminish if not to disappear entirely. Such is the situation on the addition of sodium fluoride or sodium fluosilicate to a drinking water where the concentration does not exceed 1.0 ppm fluorine. It is not to be anticipated therefore that the wide difference in solubility [2] between these two compounds would influence their physiological effects when ingested in very dilute solutions.

*From The National Institute of Dental Research of The National Institutes of Health, Bethesda, Md.

[1] The market price of these chemicals, according to Chemical and Engineering News for April 24, 1950, is sodium fluoride 95 percent c. l., wks. 0.10½ c. per lb.; sodium fluosilicate, bbl., cl., 0.04½ c. per lb. The latter compound is also known as sodium silicofluoride.

[2] NaF at 18° C. is approximately 4.0 percent soluble whereas Na_2SiF_6 is soluble to the extent of about 0.65 percent.

In dilute aqueous solutions the hydrolysis of these two fluorine salts yielding fluorine ions is comparatively simple in the case of sodium fluoride, which is practically completely ionized, but quite complex and somewhat obscure in the case of sodium fluosilicate. Although several mechanisms have been proposed, the following reactions of sodium fluosilicate account for the presence of fluoride ions in dilute solutions of sodium fluosilicate.

$$Na_2SiF_6 \longrightarrow 2\ Na^+ + SiF_6^=$$
$$2\ H_2O + SiF_6^= \longrightarrow 4\ H^+ + 6F^- + SiO_2$$

The later reaction is postulated by Kubelka and Pristoupil (*6*) and also by Ryss and Slutskaya (*7*). Ryss (*8*) studied the hydrolysis of Na_2SiF_6 at 11° C. at concentrations of 0.02 M. to 0.00048M., and determined the following equilibrium constants:

$$SiF_6^= \longrightarrow SiF_4 + 2F^-$$
$$K_1 = 0.65 \times 10^{-6}$$
$$SiF_4 + 2\ H_2O \longrightarrow SiO_2 + -4\ HF$$
$$K_2 = 1.04 \times 10^{-8}$$
$$SiF_6^= + 2\ H_2O \longrightarrow SiO_2 + 4\ H^+ + 6\ F^-$$
$$K_3 = 5.4 \times 10^{-27}$$

Rees and Hudleston (*9*) suggest a slow reaction as follows:

$$SiF_6^= \longrightarrow SiF_4 + 2F^-$$

followed by a relatively rapid reaction

$$SiF_4 + 3\ H_2O \longrightarrow 4HF + H_2SiO_3$$

As would be expected in the light of the above evidence, aqueous solutions of sodium fluosilicate have an acid reaction in the range of pH 3. 5–4. 0, and the hydrolysis is sufficient also to permit a quantitative titration of fluosilicate solutions with a standard alkali or with a standard solution of sodium carbonate.

The physiological effects of sodium fluosilicate vs. sodium fluoride have been observed most often in chronic fluorine toxicosis manifested by the characteristic effects of fluorine on rats' incisor teeth. De Eds and Thomas (*10*) thus compared NaF, Na_2SiF_6 and Na_3AlF_6 at levels of 14–16 ppm fluorine and concluded that chronic fluorine intoxication in rats as mainfested by bleaching of the rats' incisors occurred to practically the same extent from all the above fluorides. Smyth and Smyth (*11*) compared barium fluosilicate and cryolite (Na_3AlF_6) when fed to rats at levels of approximately 40 and 80 ppm fluorine and concluded that "the chronic toxicity of these compounds is substantially the same as that of sodium fluoride for the same fluorine content." (*11*) They observed a total of 246 rats and based their conclusions on rate of growth, fecundity, mortality, tooth development, organ pathology, and disease. Smith and Leverton (*12*) studied the effects of a number of different fluorides when fed to rats so as to

provide 14 ppm fluorine in the ration. Their conclusions, although based on comparatively few rats, were summarized as follows:

"Fluorine combined as ammonium and potassium fluoride or as barium, potassium and sodium fluosilicate was found to have the same acute toxicity as when combined as sodium fluoride . . . It would appear, therefore, that there is not a great difference in toxicity of fluorine in different combinations when the amount required to produce the first discernible effect upon the tooth is the basis for comparison . . . It was found that a daily dose of 0.2 mg. of fluorine from any of the sources tested resulted in abnormal incisors of the 1-type . . . Barium fluosilicate in spite of its relative insolubility has been found in every case to equal sodium fluoride in toxicity when fed at the same level of fluorine . . . It has not been possible to demonstrate a contributing toxic effect of either barium or silicon."

A comparative study of the rate of retention and paths of excretion of fluorine when fed to rats as sodium fluoride, sodium fluosilicate, and calcium fluoride was made by Kick et al. (*13*). The data acquired are as follows:

	Fluorine source			
	Na_2SiF_6	Na_2SiF_6	NaF	CaF_2
Number of rats	3	3	3	3
Approximate initial weight (gm.)	125	125	125	125
Days on experiment	23	22	18	11
Fluorine ingested—total mg	269. 9	269. 9	211. 2	229. 2
Fluorine ingested—daily mg	11. 7	12. 3	11. 7	20. 8
Fluorine in feces (mg.)	94. 3	94. 4	116. 5	225
Fluorine in feces (percent)	34. 94	34. 98	55. 16	98. 17
Fluorine in urine (mg.)	93. 6	90. 2	25. 8	4. 2
Fluorine in urine (percent)	34. 68	33. 42	12. 22	1. 83
Fluorine absorbed (mg.)	175. 6	175. 5	94. 7	4. 1
Fluorine absorbed (percent)	65. 06	65. 02	44. 84	1. 78
Fluorine balance (mg.)	+82. 0	+85. 3	+68. 9	−00. 1
Fluorine balance (percent)	30. 38	31. 60	32. 62	. 04

In this instance there was no difference between sodium fluosilicate and sodium fluoride as regards the ultimate percent of fluorine retained in the rat's body, i. e., the percent fluorine balance in the above data. There were some differences, however, in the paths of excretion, i. e., in the urine or feces.

The metabolism of cryolite (Na_3AlF_6), another complex fluoride, has been studied quite extensively (*14*, *15*, *16*) and the results may be of interest for comparison with the metabolism of Na_2SiF_6. A study of the toxicity of fluorine in calcium fluoride and in cryolite (*14*, *15*) thus brought out evidence that "the fluorine in cryolite is no more toxic to growing rats nor is it retained in the body to a greater extent than the fluorine in calcium fluoride, when both are administered in aqueous solution at the rate of 0.58 mg. per kilogram of body weight daily. . . . The appearance of striations in the incisor teeth is equally rapid with both fluorine compounds" (*14*). On the average

approximately 59 percent of the ingested fluorine from both calcium fluoride and cryolite was retained by growing rats (*14*). In making this comparison of cryolite and calcium fluoride it was assumed by these authors that the fluorine in potable waters, insofar as it is in a nonionized condition, is in the form of calcium fluoride. In other experiments with cryolite, somewhat older rats retained the fluorine from synthetic cryolite, fine natural cryolite, and coarse natural cryolite in the following percentages, respectively: 36.14 percent, 32.03 percent, and 30.70 percent. Kick et al. (*13*), as already noted, also found about 30 percent of the fluorine in sodium fluosilicate, and sodium fluoride was retained by half-grown rats. The percent retention figures we obtained in this study agree with these later percentage figures (*13*, *14*).

For a comprehensive review of sodium fluosilicate, its industrial uses and properties, a recent article by Hampel (*17*) should be consulted.

Plan of Experiment

One of the most pronounced biological effects of fluorine is its deposition in body tissues, particularly in bones and teeth. The body-retention of fluorine as offered to growing rats in the form of sodium fluoride and sodium fluosilicate is a reliable comparative criteria, therefore, of the physiological properties of these two chemically different fluorides. Specifically, in these experiments sodium fluoride and sodium fluosilicate were added to rats' drinking water in fluorine-equivalent quantities, and the concentration of fluorine in the rats' body tissues was determined.

Four series of experiments were completed as shown in tables 1, 2, 3, and 4 and in figures 1 and 2. In experiment 1 (table 1), groups of rats were fed ad libitum and drank water (ad libitum) containing 5, 10, 15, 25, and 50 ppm of fluorine added as sodium fluoride or sodium fluosilicate. After 90 to 100 days on the fluoride regimen, the rats were killed and the incisor teeth, molar teeth, mandibles, and femurs were analyzed for ash, calcium, phosphorus, and fluorine. In this experiment and in the succeeding experiments, the rats' diet consisted of cornstarch 66.5 percent, whole milk powder 27.0 percent, yeast 5.0 percent, cod liver oil 1.0 percent, NaCl 0.5 percent, 10 ppm of copper, and 100 ppm of iron.

In experiment 2, 11 litter mate pairs of weanling rats were given drinking water containing 5.0 ppm fluorine as sodium fluoride or sodium fluosilicate. The daily intake of drinking water was measured, so that each pair of rats ingested equal quantities of the respective fluorides. The rats were on experiment an average of 81 days. At the end of the experiment the rats were killed and the ash and fluorine content of the molar teeth, incisor teeth, and femurs were determined.

Table 1. *Comparison of fluorine ingested as NaF vs. Na_2SiF_6 by rats from drinking water and*

Table 1. *Comparison of fluorine ingested as NaF vs. Na_2SiF_6 by rats from drinking water and retention of fluorine and effect on ash, calcium, and phosphorus in bones and teeth*

	NaF	Na_2SiF_6	NaF	Na_2SiF_6	NaF	Na_2SiF_6	NaF	Na_2SiF_6	NaF	Na_2SiF_6	Averages	
											NaF	Na_2SiF_6
Fluorine in drinking water (ppm)	5	5	10	10	15	15	25	25	50	50		
Number of rats	20	20	17	19	19	20	17	23	23	27	(96)	(109)
Days on experiment	90	90	92	92	97	97	99	99	103	103	96	96
Initial weight (gm.)	30	30	30	30	31	30	32	30	30	30	30	30
Final weight (gm.)	122	115	131	134	139	148	145	162	148	148	137	143
Total gain (gm.)	92	85	101	104	108	118	113	132	118	118	107	113
Average daily gain (gm.)	1.0	0.9	1.1	1.1	1.1	1.2	1.1	1.3	1.1	1.1	1.1	1.2
Results of tissue analyses in percentages												
Incisor teeth-ash	73.33	81.77	81.40	80.60	81.95	80.13	80.68	80.72	79.73	81.62	79.42	80.97
Fluorine in ash	.020	.017	.041	.030	.050	.065	.094	.096	.147	.129	.070	.065
Calcium in ash	33.70	34.89	34.18	34.66	34.65	34.45	33.47	32.84	34.80	34.44	35.62	34.26
Phosphorus in ash	19.53	19.13	19.12	20.25	18.58	19.82	19.62	20.08	18.72	20.52	19.11	19.96
Calcium to phosphorus in ash	1.73	1.82	1.79	1.71	1.86	1.74	1.71	1.64	1.86	1.68	1.79	1.72
Molar teeth-ash	75.37	77.96	76.63	76.92	76.05	75.72	77.14	76.95	76.82	77.36	76.40	76.98
Fluorine in ash	.039	.037	.061	.059	.092	.096	.110	.123	.170	.186	.095	.098
Calcium in ash	36.17	35.77	35.41	36.84	35.33	35.05	36.47	36.07	35.34	35.50	35.74	35.85
Phosphorus in ash	18.37	17.76	18.15	18.63	18.12	18.90	18.27	17.41	17.57	16.92	18.10	17.92
Calcium to phosphorus in ash	1.97	2.01	1.95	2.09	1.95	1.85	2.00	2.07	2.01	2.10	1.98	2.00
Mandibles-ash	67.70	70.71	69.88	68.52	70.17	69.29	69.99	69.24	69.49	70.33	69.45	69.62
Fluorine in ash	.062	.057	.104	.096	.163	.161	.216	.220	.347	.329	.178	.173
Calcium in ash	36.23	37.17	36.14	36.06	36.75	37.25	35.56	37.01	37.17	36.21	36.37	36.74
Phosphorus in ash	18.00	18.76	17.71	18.22	17.35	16.96	18.00	17.46	18.31	18.58	17.87	18.00
Calcium to phosphorus in ash	2.01	1.99	2.04	1.98	2.12	2.20	1.98	2.12	2.03	1.95	2.04	2.04
Femur-ash	58.85	62.77	62.23	59.28	64.20	65.22	63.65	66.19	62.32	67.35	62.25	64.16
Fluorine in ash	.077	.063	.126	.116	.186	.182	.270	.281	.424	.393	.217	.207
Calcium in ash	36.72	34.85	36.05	36.36	37.65	37.06	36.52	36.27	37.77	36.62	36.94	36.23
Phosphorus in ash	18.78	18.24	18.26	18.20	18.94	18.44	18.46	17.78	18.48	17.97	18.58	18.13
Calcium to phosphorus in ash	1.96	1.91	1.97	2.00	1.99	2.01	1.98	2.04	2.04	2.04	1.99	2.00

Table 2. *Comparison of* NaF *vs.* Na_2SiF_6 *as a source of 5 ppm fluorine in rats' drinking water (average data for 11 pairs of rats in experiment 2)*

Experiment data	Fluorine exposure	
	NaF	Na_2SiF_6
Total fluorine intake (mg.)	5. 4	5. 4
Initial body weight (gm.)	39. 4	36. 8
Total gain in weight (gm.)	153. 2	142. 5
Days on experiment	81. 0	81. 0
Average daily gain (gm.)	1. 89	1. 76
Molar teeth analysis		
Total weight (mg.)	113. 6	135. 0
Percent ash	76. 91	76. 85
Percent fluorine in ash	. 029	. 032
Total fluorine (mg.)	. 025	. 033
Incisor teeth analy. is		
Total weight (mg.)	249. 4	235. 8
Percent ash	74. 57	74. 62
Percent fluorine in ash	. 017	. 018
Total fluorine (mg.)	. 032	. 031
Femur analysis		
Total weight (mg.)	699. 1	616. 4
Percent ash	61. 38	64. 38
Percent fluorine in ash	. 070	. 065
Total fluorine (mg.)	. 301	. 259

In experiment 3, the rats ingested 15 ppm fluorine in drinking water. Over a period of 98–100 days, paired rats were given equal quantities of fluorine as sodium fluoride or sodium fluosilicate. In this experiment, food and water consumption was ad libitum but the water ingestion was measured. At the end of the experiment, the rats were killed and an analysis of ash and fluorine was made on the molar and incisor teeth and on the mandibles. The remaining body carcass was also analyzed for fluorine. In experiment 4, a comparison was made between sodim fluoride, sodium fluosilicate, and sodium fluoride plus sodium silicate using seven trios of rats. The fluorine in the drinking water was 25 ppm. The sodium fluosilicate solution contained 6.2 ppm of silicon. Sodium silicate was added to sodium fluoride to furnish 15 ppm of silicon in order to test the effect of silicon per se on the fluorine retention.

The molar teeth, incisor teeth, and the body carcass were analyzed for ash and fluorine.

In experiments 3 and 4, the measurements of total fluorine intake and subsequent analysis for total fluorine in the rat's body furnished data for a calculation of the total fluorine retained by the rats, i. e.,

Table 3. *Comparison of* NaF *and* Na_2SiF_6 *as a source of 15 ppm of fluorine in rats' drinking water (average data for 10 pairs of rats)*

Experiment data	Fluorine exposure	
	NaF	Na_2SiF_6
Total fluorine intake (mg.)	19. 8	20. 2
Initial body weight (gm.)	36. 9	38. 8
Total gain in weight (gm.)	165. 7	168. 2
Average daily gain (gm.)	1. 69	1. 68
Molar teeth analysis		
Total weight (mg.)	131. 7	130. 1
Percent ash	77. 18	76. 72
Percent fluorine in ash	. 087	. 093
Total fluorine (mg.)	. 088	. 093
Incisor teeth analysis		
Total weight (mg.)	245. 5	257. 5
Percent ash	77. 88	76. 85
Percent fluorine in ash	. 062	. 066
Total fluorine (mg.)	. 118	. 130
Mandibles analysis		
Total weight (mg.)	307. 7	311. 1
Percent ash	69. 98	69. 93
Percent fluorine in ash	. 145	. 153
Total fluorine (mg.)	. 313	. 332
Fluorine in carcass* (mg.)	6. 035	6. 729
Total fluorine retained (mg.)	6. 553	7. 284
Total percent fluorine retained	33. 10	36. 06

*Minus mandibles, molars, and incisors

the fluorine balance. Preparation of the rats' tissues for analysis was as follows: the digestive tract was removed and emptied of food residues, and the entire carcass autoclaved for 10 minutes at 15 pounds pressure. Incisor and molar teeth, mandibles, and femurs were removed and the remainder of the carcass was mascerated to a homogeneous pulp in a Waring Blendor.

Fluorine was determined in the teeth and bones by first extracting them with alcohol and ether drying, and ashing at 550° C. An aliquot sample of the homogenized carcass was dried and ashed at 550° C. using a CaO suspension as a fixative, and fluorine was determined on the ash. The fluorine in the ash was determined by the usual steam distillation from perchloric acid, evaporation of the distillate, and titration with standard thorium nitrate (*18*).

Results of Experiments

In all these experiments on the growing rats, no different effects of sodium fluoride and sodium fluosilicate became apparent. Groups of

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Table 4. *Comparison of* NaF, Na_2SiF_6, *and* $NaF+Na_2SiO_3$ *as a source of 25 ppm fluorine in rats' drinking water (average data for 7 trios of rats)*

Experiment data	Fluorine exposure		
	NaF	Na_2SiF_6	$NaF+Na_2SiO_3$
Total fluorine intake (mg.)	33. 0	31. 5	33. 3
Initial body weight (mg.)	38. 4	36. 1	44. 4
Total gain in weight (gm.)	137. 9	159. 6	161. 0
Days on experiment	107. 0	105. 0	106. 0
Average daily gain (gm.)	1. 29	1. 52	1. 51
Molar teeth analysis			
Total weight (mg.)	126. 5	134. 2	137. 5
Percent ash	77. 16	77. 23	77. 72
Percent fluorine in ash	. 178	. 176	. 187
Total fluorine (mg.)	. 173	. 183	. 220
Incisor teeth analysis			
Total weight (mg.)	263. 2	261. 1	276. 8
Percent ash	78. 28	77. 91	77. 36
Percent fluorine in ash	. 101	. 101	. 103
Total fluorine (mg.)	. 208	. 204	. 221
Fluorine in carcass* (mg.)	12. 29	12. 69	10. 58
Total fluorine retained (mg.)	12. 66	13. 07	11. 02
Total percent fluorine retained	38. 36	41. 49	33. 09

*Minus molar and incisor teeth.

rats ingesting fluorine in their drinking water ad libitum at levels of 5, 10, 15, 25, and 50 ppm fluorine, as sodium fluoride and sodium fluosilicate (table 1), did not have different percentages of fluorine in the ash of the bones and teeth which could be related to the kind of fluoride fed. Similarly, no differences occurred in the percent of ash calcium and phosphorus and the calcium to phosphorus ratio in the molar and incisor teeth, mandibles, and incisors. Average daily gain in body weight was similar in all groups of rats.

The data in table 2 were obtained by equalizing the drinking water ingested by pairs of rats over a period of 81 days, so that the total quantity of fluorine was the same for both rats of a pair. The average results for 11 pairs of rats receiving 5 ppm fluorine in their drinking water are shown in table 2. Here again it is apparent that the percent of fluorine in the ash of the molar teeth, incisor teeth, and femurs was not related to the source of fluorine, i. e., sodium fluoride or sodium fluosilicate.

The fluid intake was measured, and the final total quantity of drinking fluid (and thus the total fluorine ingested) was equalized in 10 pairs of rats. The average results of this study appear in table 3.

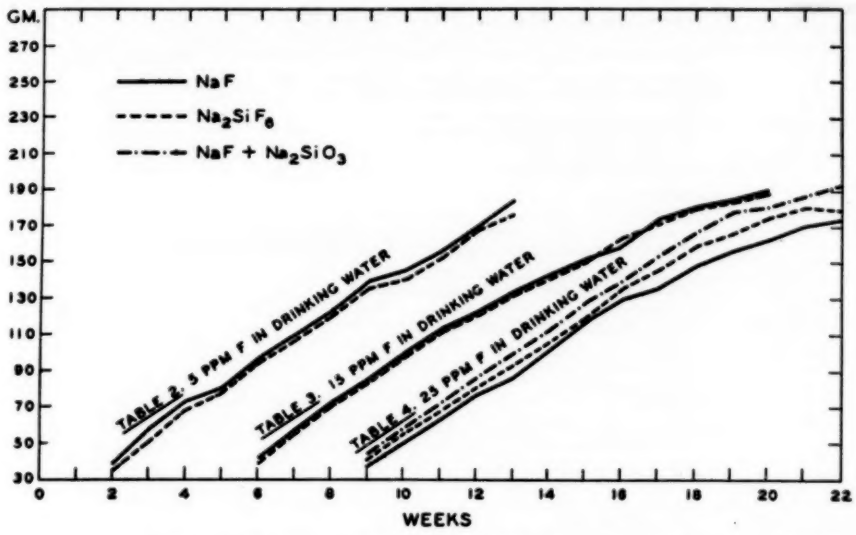

Figure 1. Average rate of growth of rats receiving sodium fluoride, sodium fluosilicate, and sodium fluoride plus sodium silicate in drinking water.

The amount of fluorine in the drinking water was 15 ppm. No differences in the ash and the fluorine content of the ash of teeth and mandibles occurred. The fluorine retained in the rat's entire body amounted to 33.10 percent of the total ingested as sodium fluoride, and 36.06 percent of the total ingested as sodium fluosilicate. The difference between these two percentage figures is not significant. In these 10 paired results for sodium fluoride vs. sodium fluosilicate the mean difference in percent retention was 2.96 with a standard error of ± 6.56.

In table 4 are the results of adding 25 ppm fluorine to the drinking water as sodium fluoride, sodium fluosilicate, and sodium fluoride plus sodium silicate. No differences appear in the results for ash and fluorine in the molar and incisor teeth. While the percent of ingested fluorine which was retained by the rats receiving sodium fluoride plus sodium silicate amounted to 33.09 percent as compared with 38.36 percent retention of fluorine ingested as sodium fluoride alone, the difference between these two values is not statistically significant. The mean difference for these seven paired comparisons was 5.27; the standard error was ± 5.89.

Similarly, there is no significance in the difference, 38.36 percent vs. 41.49 percent, i. e., the percent fluorine retained from sodium fluoride vs. sodium fluosilicate.

Figure 2 shows the relations between the fluorine in the ash of incisors, molars, mandibles, and femurs at different levels of fluorine in drinking water. As would be expected, these quantities are proportional to the fluorine ingested and the similarity between the two

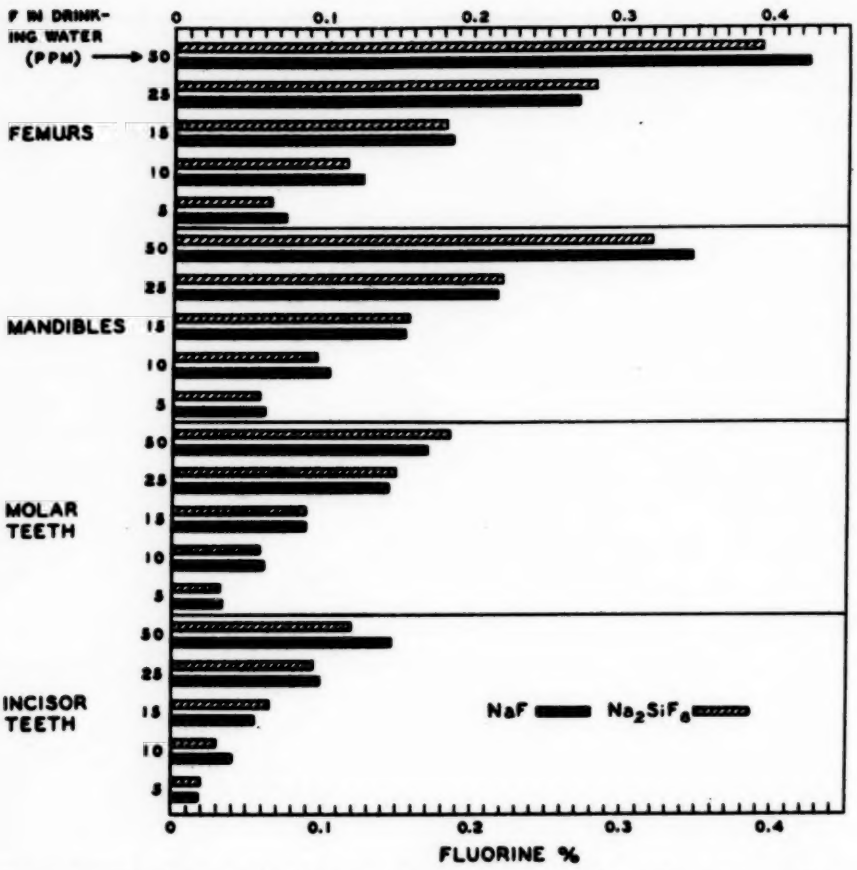

Figure 2. Fluorine in ash of bones and teeth of rats receiving fluorine as sodium fluoride or sodium fluosilicate in drinking water.

fluorides ingested is shown in the percentage figures. There is a slightly greater percent of fluorine in the ash of the femurs, than in the ash of mandibles, but there is also less ash in the femurs than in the mandibles. The percent fluorine in the fat-free mandibles and in the fat-free femurs is essentially the same.

The appearance of the characteristic striations in these rats' incisor teeth did not show variations which could be related to the kind of fluoride ingested. The striations varied with the level of fluorine in the drinking water and were most apparent in the lower incisors. At a level of 10 ppm fluorine, incisor striations were easily apparent under low power magnification. At 5 ppm fluorine in the drinking water, striations could not be seen, but there was some tendency toward slight depigmentation in several rats. Considerable spotty depigmentation occurred at 25 ppm fluorine and over.

The average rate of growth of the various groups of rats is indicated by the growth curves shown in figure 1. The essential similarity in

rate of growth for all groups of rats suggests no differences in the rats' reaction to sodium fluoride vs. sodium fluosilicate. The presence of sodium silicate in the drinking water (experiment 4) also had no effect on growth.

These results are in general agreement with the previous evidence of similar physiological effects of these two fluorine compounds. While the similarity in the quantities of fluorine retained in the teeth and skeletal tissues is the most pertinent evidence obtained in these experiments, the other data relative to ash, calcium and phosphorus, and the calcium to phosphorus ratio of bones and teeth, the rate of growth, and the appearance of characteristic striations in the rats' incisors, also contribute evidence that similar physiological effects result from these two fluorides.

As additional data are obtained, particularly with reference to dental caries effects, conclusions may be warranted regarding the possibility of substituting sodium fluosilicate for sodium fluoride, as a water fluoridizing agent. The data accumulated thus far, however, do not justify any commitments in this regard.

Summary

1. A comparison was made of the effect of fluorine ingested by rats from drinking water in the form of sodium fluoride vs. sodium fluosilicate; the quantity of fluorine equaled 5, 10, 15, 25, and 50 ppm.

2. No differences were observed in the quantity of fluorine deposited in the incisor and molar teeth, mandibles, and femurs, nor in the percent of the ingested fluorine which was retained in the rat's body. There was no difference in the ash, calcium, and phosphorus content of the incisor teeth, molar teeth, mandibles, and femurs which could be related to the kind of fluoride ingested.

3. There were no differences in the appearance of the characteristic striations on the rats' incisor teeth which could be attributed to the sodium fluoride vs. sodium fluosilicate.

4. The presence of 15 ppm of silicon as sodium silicate along with 25 ppm of fluorine as sodium fluoride did not affect the amount of fluorine deposited in the rat's body.

5. The rate of growth was normal in all groups of rats.

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Use of the Chick Embryo for Isolation of *Brucella*

Multiplication of the Organism in the Yolk Sac and Selection of the Embryo Age Optimal for Isolation From Blood

By KATHLEEN GAY, B.S., and S. R. DAMON, Ph.D.*

Public health laboratories have long been concerned with the problem of isolating *Brucella* from blood specimens and in many instances have felt that the available means of isolation, by cultural methods and by guinea pig inoculation, have not been adequate. Not only has the percent of recoveries from patients reported as having clinical brucellosis been low, but the time and cost involved in making these isolations have been excessive. Consequently, soon after commencement of the Indiana Brucellosis Study Project the question arose as to whether or not there might be a more satisfactory means of isolating *Brucella*.

This report presents the first phase of the study of the chick embryo as a possibly superior enrichment medium for the recovery of *Brucella* from the blood stream.

Review of Literature

As early as 1937 Goodpasture and Anderson (*1*), studying the infectivity of *Br. abortus* for the chick embryo, showed that this organism reproduced within living cells of the chorio-allantoic membrane. More recently, various investigators of the pathology and infectious nature of brucellosis, e. g., Buddingh and Womack (*2*) and Ruiz-Castaneda (*3*), have presented a picture of the causative organism as preferentially an intracellular parasite. In view of the fact that this multiplication within the cell is a character common to viruses and rickettsiae, it seemed logical that the techniques employed in isolating these agents would be applicable to the recovery of *Brucella*. Because the yolk is highly nutritive and the sac itself is capable of receiving a sizeable amount of blood inoculum without injury to the developing embryo, as already determined by virologists, this region of the incubating egg was selected first for study.

Most investigations of *Brucella* in which the yolk-sac technique has been employed have been in the study of therapeutic agents and the pathology of the infection. Spink et al. (*4*), in evaluating antibiotics,

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used a *Br. abortus* inoculum of approximately 356 organisms and consistently recovered them from embryo livers 24 to 72 hours later. Still others have used a much more concentrated inoculum. However, since injection of numbers of organisms comparable to those in a natural blood specimen could not always be assured, it appeared that the first step should be a study of the multiplication of minimal inocula within the yolk material itself. Also, since there are known generally to be certain conditions under which an inoculum of a few organisms fails to multiply, it seemed essential to determine whether or not these conditions existed in the yolk sac at certain stages of embryonic development.

The experiments presented in this report and the resulting growth curves formed the basis for selecting a particular embryo age to be used in attempted recoveries of *Brucella* from the blood stream, and the subsequent elimination of other ages as probably unsatisfactory.

Materials and Methods

White leghorn eggs from pullorum-free flocks were used throughout the experiments. The average weight of each was 59.25 ± 3.46 gm. Incubation before and after inoculation was in a regular egg incubator set at 98°–99° F. (37° C.±) and equipped with an automatic turning device. The relative humidity was held at 50°–56°. The three *Brucella* strains used (*melitensis* No. 4463, *abortus* No. 318 and *suis* No. 614) had been isolated in this laboratory from the blood stream of patients showing an agglutination titer of 1:320 or higher. All three strains were completely typical of their respective types and were kept under refrigeration on tryptose agar slants and transferred every 3 months. Throughout the experiments their virulence for chick embryos did not change, the *melitensis* strain producing 100 percent death at 5–6 days; *suis*, at 4–5 days; and *abortus*, at 7–8 days.

Preparation of a Standard Inoculum

In preparing a standard inoculum for injection into the yolk sac of the embryos, a method which consistently gave a comparable number of organisms per aliquot of broth diluent was devised and followed throughout. It was briefly this: a tryptose agar plate streaked from the stock slant was incubated 3–4 days and a colony transferred to 10 ml. of tryptose broth. Exactly 24 hours later the incubated broth culture was diluted 10^{-5} (tenfold dilutions in 10 ml. total volumes) for *melitensis* and *abortus*, and 10^{-6} for the faster growing *suis* strain. The *abortus* strain required incubation in a CO_2 atmosphere of approximately 10 percent for multiplication. The foregoing technique resulted in a standard inoculum for each egg group as shown in the table.

Determination of Bacterial Inoculum

The determination of the number of organisms which each egg received and the logarithms of the counts plotted for the growth curves is based upon a technique proposed by Miles and Misra (*5*). Six 0.02 ml. aliquots of the dilution to be examined were placed in spots upon the surface of each of six tryptose agar plates (the tryptose buffered to pH 6.6 with NaOH) which had been dehydrated sufficiently to absorb the diluent in 15 minutes. The plates were then incubated at a constant temperature (36° C.) for 3 to 4 days, and a colony count was made from the growth resulting at the location of each spot of absorbed liquid. On the basis of previous experience, a range of dilutions was selected for plating so that one would show between 5–50 colonies per 0.02 ml.; the bacterial numbers were then calculated from the definitive dilution in each instance.

Inoculation and Examination of the Yolk

After each egg had been candled for normal development and for embryo position, a small hole was made at the large end with a table model dental drill and a No. 6 carborundum point. The injection was made through this opening with a tuberculin syringe and 20-gage needle so that the inoculum was introduced centrally into the yolk sac. Before and after inoculation, the area around the opening was painted with tincture of iodine and the hole finally sealed with collodion. On the day the yolk was to be examined, a portion was withdrawn in a manner similar to that of the injection, and tenfold serial dilutions in 1.0 ml. total volumes were made immediately. These dilutions were plated as previously described for the determination of the bacterial inoculum.

Experimental Results

Melitensis *Growth Curves*

The first growth curve of the *melitensis* strain (curve A in fig. 1) was obtained by injecting the standard inoculum, i. e., 0.1 ml. of the 10^{-5} dilution of a 24-hour broth culture, into the yolk sacs of 24-hour embryos. Each day thereafter, until the completion of the curves, the eggs were candled and three successive eggs which showed normal embryonic development were examined by withdrawing 0.1 ml. of the yolk and diluting it in tenfold serial dilutions sufficiently to obtain definitive bacterial counts, as described. Because of the error which would be introduced by the withdrawal of yolk, each daily examination was based upon the contents of three eggs which had not been previously examined. The number of bacteria per ml. of yolk was then computed on the basis of the method for determin-

ing bacterial numbers, the average of the three logarithms constituting one point on the curve.

This experiment was repeated, utilizing eggs which had incubated for 2, 3, 4, 5, and 6 days, respectively. The calculated numbers of bacteria each egg received are presented in the table.

Number of organisms in each inoculum

Egg group	Age of embryo	Numbers
A	1 day	22 ±2
B	2 days	102 ±4
C	3 days	79 ±3
D	4 days	72 ±5
E	5 days	78 ±3
F	6 days	95 ±3

The results of this experiment are presented in figure 1 as six curves which represent the relative rates of multiplication of *melitensis* when injected in small numbers into the yolk sacs of groups of embryos (A, B, C, D, E, and F) which had reached each of the six daily stages of development. Due to the difficulty of obtaining reliable counts from undiluted material, the lowest yolk dilution examined was the 10^{-1}. The curves terminate on the sixth day following the injection, since death of the embryos, irrespective of their ages when the inoculations were made, consistently occurred at this time. Each point on curves C, D, E, and F was obtained by averaging the logarithms of the bacterial counts from three eggs; however, curves A and B need a word of explanation. Repeated attempts usually failed to yield three comparable counts from these egg groups at any one time; consequently, each point is the logarithmic average of those eggs which showed growth, i. e., two or three eggs.

It will be seen from figure 1 that the curves obtained from egg groups C, D, E, and F, particularly from E and F, approximate one another whereas those from groups A and B indicate a definite variation. It should be noted that on the fourth day following injection, if growth occurred, irrespective of the age of the embryo when the injection was made, the curves tended to coalesce.

The table shows that the number of organisms contained in the inoculum injected into egg group A was fewer than those received by the other groups; however, other experiments have shown fairly well that this difference in numbers does not alter the picture.

Suis *and* Abortus *Growth Curves*

Since the 5-day-old chick embryos appeared to provide the most favorable and most consistent environment for rapid multiplication

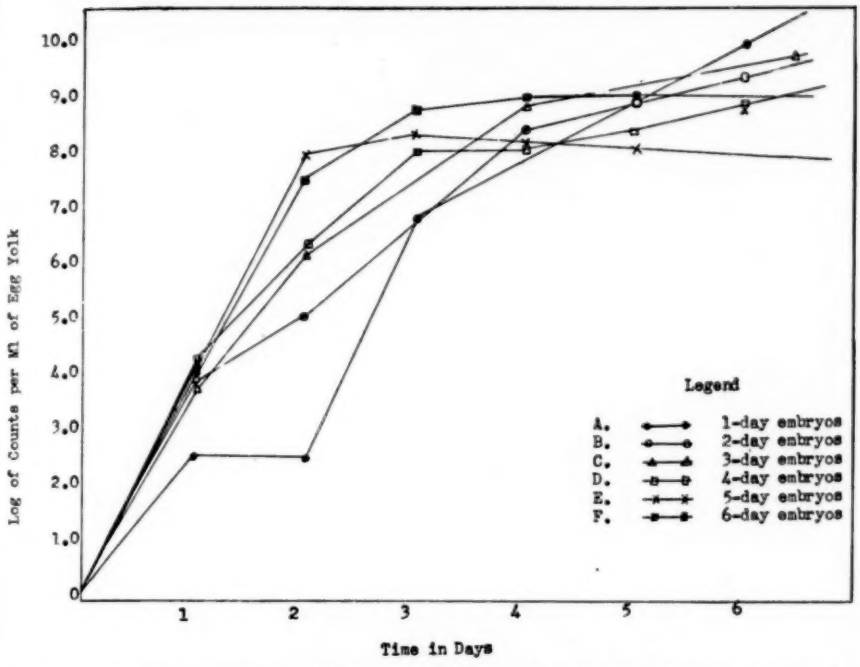

Figure 1. Curves showing multiplication of *Br. melitensis* when injected into yolk sacs of 1- to 6-day-old embryos.

of the *melitensis* strain, it seemed desirable to repeat the experiment with a *suis* and an *abortus* strain injected into the yolk sacs of 5-day-old embryos. The average number of *suis* organisms in each inoculum was 26 (±2), of *abortus*, 92 (±4). The results of this experiment are plotted in figure 2 against the base growth curve for *melitensis*, obtained in the foregoing experiments. Each plotted point represents the averaged logarithms of the counts obtained from three separate eggs.

The three strains examined appeared to multiply at a comparable rate.

Melitensis *Growth Curve in Presence of Blood*

An experiment was performed to see if the presence of blood would exhibit any bacteriostatic effect under the conditions of this study. A 24-hour broth culture of the *melitensis* strain was prepared as previously described and mixed with defibrinated rabbit blood in the proportion of 1 part of 10^{-5} culture dilution and 4 parts of blood. This mixture was incubated in a 37° C. water bath for 30 minutes, then it was again mixed thoroughly and 0.5 ml. injected into each of 23 eggs, the number of organisms per egg averaging 96 (±4). The egg yolk was then examined daily as in previous experiments and the results are presented in figure 3. Again, the curve obtained was

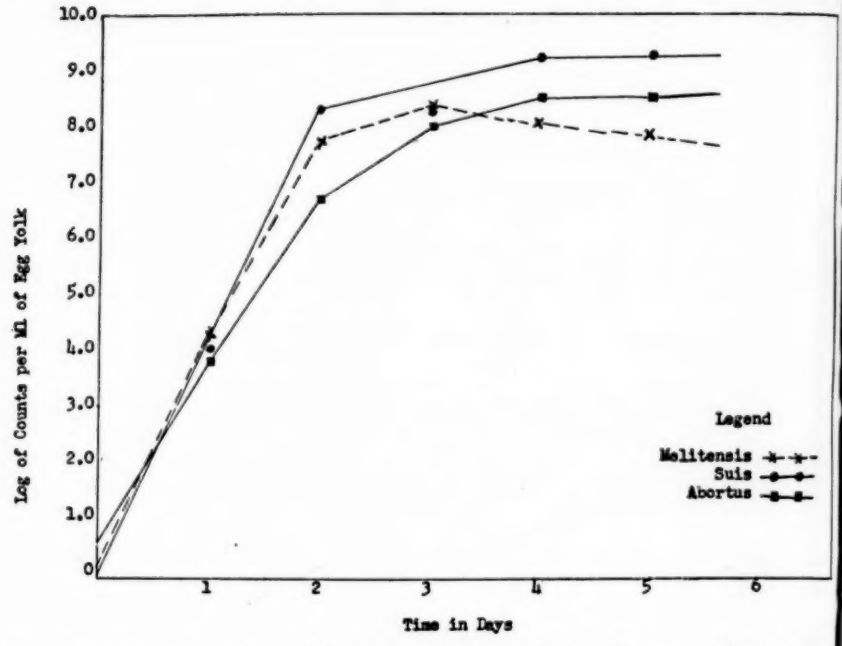

Figure 2. Curves showing multiplication of the three *Brucella* types when injected into yolk sacs of 5-day-old embryos.

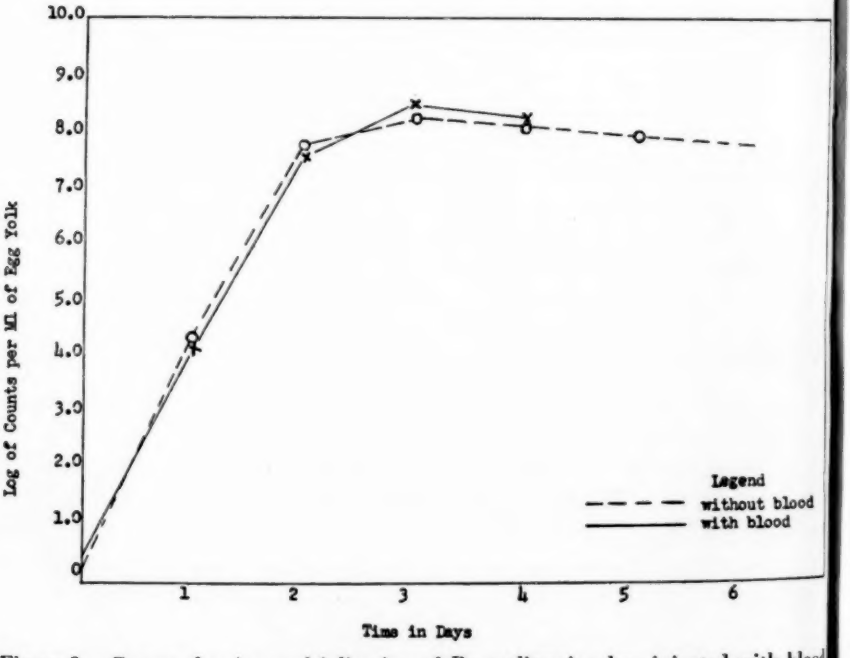

Figure 3. Curves showing multiplication of *Br. melitensis* when injected with blood into yolk sacs of 5-day-old embryos.

practically identical with the one plotted as the standard curve for the *melitensis* strain when injected into 5-day-old eggs.

Discussion

Throughout many experiments conducted prior to and following this series, the results have been amazingly consistent when the standard inoculum was injected into 5-day-old chick embryos. This uniformity has not always been observed when the injections were made at any of the other ages which have been studied. Thus, when a few *melitensis* organisms were injected into the yolk sacs of 1- or 2-day-old embryos, it was observed frequently that multiplication apparently failed to occur, since even after 8 or 9 days further incubation growth was not detected in the yolk material of some of these eggs. On the other hand, when as few as 1 to 10 organisms have been injected into the 5-day embryos, growth has consistently occurred.

It has been interesting to speculate concerning this variation and several explanations have seemed plausible. At first it was thought that perhaps the inoculum was not properly placed within the yolk area. However, since the exact location of the yolk was carefully determined prior to injection and the technique varied according to the age of the embryo, this explanation seemed inadequate. Second, there is the physical difference in the yolk at the various stages of embryonic development. During the first 48 hours it remains quite viscid. On the third day of incubation it begins to enlarge and become more fluid and by the fifth day is quite liquid. It would seem that the more viscid the yolk the slower the dissemination of multiplying bacteria from the original point of injection, and if such is the case, then an examination of the yolk during the first few days may or may not reveal growth, depending upon the age of the embryo and the degree of approximation of the 0.1 ml. aliquot of yolk examined to the original point of injection. However, this condition does not account for the fact that at times the inoculum is never recovered from the yolk of those eggs which had 1- or 2-day embryos at the time of the injection.

Beveridge and Burnet (*6*), in their review of the literature concerned with egg techniques, quote several authors who have studied the presence of antibody and natural resistance in the yolk of the hen egg. This work indicates that the freshly laid egg contains factors of resistance hereditarily acquired. Surely, it is conceivable that the presence or absence of inherent resistance may be a factor in the isolation of *Brucella* when the inoculation is made into the yolk sac. At any rate, observations made during the course of this study indicate that 1- and 2-day old chick embryos may have some resistance to small inocula of *Br. melitensis*.

As has been previously stated, the sole aim of this series of experiments has been to provide a basis for the selection of an appropriate age of embryo for further study in an attempt to adapt egg techniques to the isolation of *Brucella* from the blood stream. Consequently, the 5-day-old embryo has been selected as having reached that stage of development probably offering the most favorable environment for the isolation of *Brucella*, with the 3-, 4- and 6-day embryos offering possibilities, whereas the 1- and 2-day embryos appeared definitely less desirable. It is presumed that if a given age of embryonic development is unfavorable to the multiplication of small numbers of a laboratory strain of *Brucella*, then it will also be unsatisfactory for the original isolation of this organism from the blood stream.

Summary

1. Relative growth curves for a strain of *Br. melitensis*, when injected in small numbers into the yolk sacs of 1- to 6-day-old chick embryos have been presented and the variations resulting from the inoculation of 1- and 2-day embryos noted.

2. Growth curves obtained when this *melitensis* strain was inoculated into 5-day chick embryos and when a *suis* and an *abortus* strain were likewise injected were found to be comparable.

3. As a result of observations made during this study, the 5-day-old embryo has been selected as having reached that age which appears to offer optimum conditions for recovering *Brucella* from the blood stream because (1) it has given the most consistent results throughout these experiments, (2) it is an age easily adaptable to a routine procedure and (3) it affords a fairly long period for the enrichment of slow-growing strains before the yolk becomes dehydrated.

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Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports from States for Week Ended August 26, 1950

For the current week, new cases of acute poliomyelitis reported in the Nation numbered 1,617, an increase of 128 or 8.6 percent over the 1,489 cases reported last week. This is the fourteenth week of consecutive increase over the preceding week, beginning with the week ended May 27. During this period increases over the preceding week ranged from a high of 57 percent for the week ended June 10 to 3 percent last week. The rate of increase has slackened in recent weeks.

The cumulative total (10,712) for the current "disease" year was below the corresponding total (19,616) for last year, the highest on record. The "disease" year for acute poliomyelitis begins with the

Comparative Data for Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended		5-year median 1945–49	Seasonal low week	Cumulative total since seasonal low week		5-year median 1944–45 through 1948–49	Cumulative total for calendar year		5-year median 1945–49
	Aug. 26, 1950	Aug. 27, 1949			1949–50	1948–49		1950	1949	
Anthrax (062)			[1]	[1]	[1]	[1]	[1]	29	38	[1]
Diphtheria (055)	76	142	148	27th	463	608	939	3,591	4,466	7,236
Acute infectious encephalitis (082)	18	38	23	[1]	[1]	[1]	[1]	534	417	349
Influenza (480–483)	675	566	602	30th	3,024	2,239	2,239	249,283	78,106	141,816
Measles (085)	826	613	694	35th	306,600	640,340	585,484	287,470	587,947	550,538
Meningococcal meningitis (057.0)	38	39	49	37th	[2] 3,594	3,225	3,496	[2] 2,681	2,381	2,524
Pneumonia (490–493)	673	870		[1]	[1]	[1]	[1]	61,362	56,594	
Acute poliomyelitis (080)	1,617	3,241	1,412	11th	[3] 10,712	19,616	10,187	[3] 11,846	20,531	10,654
Rocky Mountain spotted fever (104)	21	27	27	[1]	[1]	[1]	[1]	369	468	434
Scarlet fever (050)	263	226	370	32d	502	444	747	40,672	58,110	62,850
Smallpox (084)			1	35th	[3] 46	51	201	[2] 26	41	147
Tularemia (059)	21	24	14	[1]	[1]	[1]	[1]	663	823	686
Typhoid and paratyphoid fever [4] (040, 041)	121	110	138	11th	1,725	2,058	2,058	2,235	2,546	2,546
Whooping cough (056)	1,918	1,403	1,789	39th	109,859	49,624	92,350	88,323	39,591	66,332

[1] Not computed.
[2] Additions: Meningitis, Oklahoma, week ended Aug. 19, 1 case; smallpox, Mississippi, week ended Aug. 19, 1 case.
[3] Deductions: New Jersey and Michigan, week ended Aug. 12, 1 case each.
[4] Including cases reported as salmonellosis.

twelfth week of the calendar year. The cumulative total for the calendar year was 11,846, compared with the total of 20,531 for the corresponding period last year.

For the current week, total numbers of reported cases of poliomyelitis in 7 of the 9 geographic divisions increased over the preceding week. These increases ranged from 60 (320 to 380) cases reported in the East North Central States to 1 (154 to 155) case in the West North Central States. The 2 divisions reporting decreases over the preceding week were the East South Central States (120 to 109) and the West South Central States (170 to 166).

For the current week, 25 States reported increases in poliomyelitis over the preceding week. These increases ranged from 42 (21 to 63) in Wisconsin to 1 in Vermont. Other increases were noted in Connecticut (12 to 33), West Virginia (17 to 35), and California (63 to 80).

The total number of cases of whooping cough reported for the week was 1,918 compared with 1,403 for the corresponding period last year. For the calendar year, a total of 88,323 cases was reported, compared with 39,591 for the corresponding period last year.

Of 42 States and the District of Columbia reporting on rabies in animals, 21 States and the District of Columbia reported no cases. The remaining 21 States reported 106 cases. This total includes 26 cases reported in New York, 20 cases reported in Texas, and 8 cases each reported in Iowa and Tennessee.

No smallpox was reported in the United States. The Arizona State Health Department reported a case of bubonic plague. This has been previously reported as a positive laboratory test by the New Mexico State Health Department.

Deaths During Week Ended August 26, 1950

	Week ended August 26, 1950	*Corresponding week, 1949*
Data for 94 large cities of the United States:		
Total deaths	8, 245	8, 060
Median for 3 prior years	8, 418	----------
Total deaths, first 34 weeks of year	315, 437	315, 874
Deaths under 1 year of age	600	649
Median for 3 prior years	705	----------
Deaths under 1 year of age, first 34 weeks of year	21, 102	22, 284
Data from industrial insurance companies:		
Policies in force	69, 642, 619	70, 222, 284
Number of death claims	10, 702	12, 617
Death claims per 1,000 policies in force, annual rate	8. 0	9. 4
Death claims per 1,000 policies, first 34 weeks of years, annual rate	9. 5	9. 4

Reported Cases of Selected Communicable Diseases: United States, Week Ended Aug. 26, 1950

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**76**	**18**	**675**	**826**	**38**	**673**	**1,617**
New England	**1**	**2**		**72**		**30**	**39**
Maine						2	1
New Hampshire							2
Vermont				2			3
Massachusetts	1	1		58			19
Rhode Island				2		1	1
Connecticut		1		10		27	33
Middle Atlantic	**4**	**2**	**1**	**201**	**8**	**154**	**314**
New York	3		[1] 1	68	4	99	184
New Jersey		2		72	3	21	53
Pennsylvania	1			61	1	34	77
East North Central	**4**	**2**	**21**	**202**	**4**	**113**	**380**
Ohio	1			47	2		86
Indiana	1	1		4		7	23
Illinois	2		3	44	1	75	113
Michigan				24		25	95
Wisconsin		1	18	83	1	6	63
West North Central	**2**		**7**	**33**	**4**	**19**	**155**
Minnesota				11	1	5	27
Iowa				2			54
Missouri	1			10	2	4	7
North Dakota			1	3		7	5
South Dakota				1			7
Nebraska			6	2	1		22
Kansas	1			4		3	33
South Atlantic	**24**	**1**	**87**	**26**	**6**	**76**	**271**
Delaware				1			2
Maryland	1	1	2	7	1	26	33
District of Columbia				2		10	10
Virginia	3		79	5	1	21	67
West Virginia	4		4	3	1	1	35
North Carolina	10			2	2		65
South Carolina	3			1	1	1	27
Georgia	3		1	1		6	23
Florida			1	4		11	9
East South Central	**15**	**1**	**25**	**28**	**6**	**55**	**109**
Kentucky	2	1		1	2		36
Tennessee			15	19	3		35
Alabama	3		8	3	1	47	15
Mississippi	10		2	5		8	23
West South Central	**20**	**2**	**431**	**77**	**7**	**177**	**166**
Arkansas	3		26	1	1	27	14
Louisiana	2			1	2	36	17
Oklahoma		1	12	2	1	8	22
Texas	15	1	393	73	3	106	113
Mountain	**3**	**1**	**86**	**62**	**2**	**21**	**34**
Montana			24	2	2		6
Idaho	2		1	14			2
Wyoming				3			2
Colorado			38	27		8	9
New Mexico			2	1		6	4
Arizona	1	1	21	7		6	6
Utah				8		1	3
Nevada							2
Pacific	**3**	**7**	**17**	**125**	**1**	**28**	**129**
Washington	1			8			34
Oregon			14	8	1	6	15
California	2	7	3	109		22	80
Alaska						1	1
Hawaii			15	2			

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Aug. 26, 1950—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [1] (040, 041)	Whooping cough (056)	Rabies in animals
United States	**21**	**263**		**21**	**121**	**1,918**	**106**
New England		**21**			**6**	**235**	
Maine		1				19	
New Hampshire						4	
Vermont						56	
Massachusetts		17			6	60	
Rhode Island		1				62	
Connecticut		2				34	
Middle Atlantic	**1**	**39**			**11**	**329**	**29**
New York	1	[2] 26			2	113	26
New Jersey		3				77	
Pennsylvania		10			9	130	3
East North Central		**77**		**2**	**14**	**490**	**15**
Ohio		26			1	84	6
Indiana		8		2	3	27	6
Illinois		12			5	50	1
Michigan		17			2	181	2
Wisconsin		14			3	148	
West North Central		**14**			**1**	**123**	**10**
Minnesota		1				16	
Iowa						25	8
Missouri		1			1	25	
North Dakota		3				13	
South Dakota		1					
Nebraska		6				5	
Kansas		2				39	2
South Atlantic	**13**	**41**		**6**	**17**	**229**	**16**
Delaware					2	3	
Maryland	6	2				20	
District of Columbia		1				15	
Virginia	2	5		2	5	28	1
West Virginia		1			3	42	4
North Carolina	5	22		1		88	
South Carolina		6		1	1	6	6
Georgia		4		2	5	22	5
Florida					1	5	
East South Central	**2**	**37**		**3**	**22**	**82**	**12**
Kentucky	1	8		1	6	7	1
Tennessee	1	17		1	11	52	8
Alabama		6			4	13	2
Mississippi		6		1	1	10	1
West South Central	**3**	**12**		**7**	**31**	**243**	**22**
Arkansas	2	4		5	7	24	1
Louisiana				2	5	8	
Oklahoma	1	2			7	12	1
Texas		6			12	199	20
Mountain	**2**	**5**		**3**	**3**	**78**	**1**
Montana						17	
Idaho		1			1	14	
Wyoming		1		3		2	
Colorado		2				4	
New Mexico	1				1	12	
Arizona					1	27	1
Utah	1	1				2	
Nevada							
Pacific		**17**			**16**	**118**	**1**
Washington		2			1	41	
Oregon		2				7	
California		13			15	70	1
Alaska						4	
Hawaii						1	

[1] Including cases reported as salmonellosis.
[2] Including cases reported as streptococcal sore throat.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended Aug. 5, 1950

Disease	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Brucellosis						1	4				5
Chickenpox			16		51	65	28	9	28	38	235
Diphtheria	11				2						13
Dysentery:											
Amebic						1					1
Bacillary					5		2			3	10
Encephalitis, infectious								1			1
German measles	1				4	63			2	9	79
Influenza			20				1				21
Measles	1		2		99	197	16	10	8	31	364
Meningitis, meningococcal			1		1						2
Mumps	1		14		49	73	2	7	42	24	212
Poliomyelitis			1		3	15		4	7	6	36
Scarlet fever			1		20	7	4	1	11	4	48
Tuberculosis (all forms)	12		8	27	160	21	22	17	8	18	293
Typhoid and paratyphoid fever					3	1					4
Venereal diseases:											
Gonorrhea	3		13	9	111	66	28	13	46	75	364
Syphilis	4	1	12	10	44	15	3	8	3	15	115
Whooping cough	1		7	2	95	42	10	2	1	18	178

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently. A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

Cholera

Burma. During the week ended August 5, 1950, 44 cases of cholera, with 30 deaths, were reported.

India (French). During the week ended August 12, 1950, 71 cases of cholera were reported in Pondicherry.

Plague

Burma. On June 17, 1950, 1 case of plague was reported in the port of Bhamo.

Indochina. During the week ended August 12, 1950, 5 cases of plague (2 deaths) were reported in Viet Nam, including 3 cases, 1 death, in Phanthiet.

Smallpox

India (Portuguese). For the week ended July 8, 1950, 5 cases of smallpox were reported.

Indonesia. During the week ended August 5, 1950, 260 cases of smallpox were reported in Surabaya and 25 cases in Jogjakarta, Java, and 30 cases were reported in Pontianak, Borneo. For the week ended August 12, 178 cases were reported in Surabaya.

Mozambique. During the week ended July 8, 1950, 18 cases of smallpox, with 2 deaths, were reported.

Peru. For the month of April 1950, 356 cases of smallpox were reported.

Typhus Fever

Peru. During the month of April 1950, 150 cases of typhus fever were reported.

Yellow Fever

Gold Coast. Suspected yellow fever has been reported as follows: On July 16, 1950, one case in Bogoso; on July 28, one death in the port of Accra.

Nigeria. One fatal case of yellow fever, imported, has been reported in Calabar. This case occurred in a seaman on a vessel bound from Dakar to Liverpool via Lagos, Burutu, and Abonema. The patient was landed at Calabar on July 30, and died on August 6.

Sierra Leone. During the period August 1–8, 1950, one fatal suspected case of yellow fever was reported at Pendembu in Kailahun District.

The suspected case reported in Koinadugu District June 24–25 (see PUBLIC HEALTH REPORTS for August 4, 1950, p. 1,001) was not confirmed.

Bubonic Plague in Arizona and New Mexico

Arizona

The case of bubonic plague at Fort Defiance, Arizona reported in the August 25 issue of PUBLIC HEALTH REPORTS, Vol. 65, No. 34, p. 1110, was confirmed by telegram dated August 29, 1950, from the Arizona Department of Health. No details were given concerning the locality of infection.

New Mexico

A report of bubonic plague was made in PUBLIC HEALTH REPORTS, Vol. 65, No. 30, p. 962, giving Pecos, San Miguel County, as the locality of the case. This was the place of death. Later reports state that the patient lived on a ranch near Glorieta in Santa Fe County.

Psychiatrists Posts in New York State

New York State is looking for candidates to fill more than 50 posts as supervising psychiatrist in State mental hospitals. The starting salary is $6,490 with five annual increases up to $7,935.

Applications may be filed up to September 29 for an open competitive examination to be held November 4, 1950, by the New York State Department of Civil Service. The examination will be conducted at about 40 centers in New York State and at other locations to accommodate out-of-State applicants.

Although New York State residence and United States citizenship are usually required of applicants for civil-service positions, in this case both requirements have been waived, except for a few jobs in institutions for the criminally insane to which only citizens may be appointed.

Candidates must have completed 2 years of residency in psychiatry in an approved hospital and 2 years of experience as a member of the staff of a psychiatric hospital, or a satisfactory equivalent. They must also be eligible to enter the examination for a license to practice medicine in New York State.

Complete details and application blanks may be obtained from the New York State Department of Civil Service, Albany.

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It contains (1) current information regarding the incidence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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